**M E M O R A N D U M**

# WATER SUPPLY AND WATER QUALITY: RECOMMENDED PLANNING PRIORITIES FOR THE REGIONAL GROWTH VISION

Prepared for the
GROWTH VISIONING SUBCOMMITTEE

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## Introduction

This memorandum is the first of several water-and-growth issue papers that will be developed for the Growth Visioning Sub-committee. The main purpose of this paper is to begin to consider the relationship between growth and water in Southern California. The preliminary information presented in this paper, therefore, is intended to help foster an initial dialogue about the potential impacts of different population growth patterns on future water demand/supply and future water quality.

In this memorandum we focus on several water supply issues. First, we review the new legislative mandate for linking water supply to the entitlements needed for housing development. Of critical importance in this new linkage is an understanding of the Urban Water Management Plan and an appreciation of the changing conditions in California and the Colorado River Basin that will affect the region's ability to import surface water. Second, we discuss the relationship between groundwater management and augmenting local water supplies. Finally, we present examples of water management practices that increase local water supplies.

In the water quality section of the memorandum we focus on the links between land use and water quality. First, we review the effects of impervious surfaces on water quality. Second, we look at the impacts of runoff that result from growth and development. Third, we discuss the typical pollutants that are carried by urban runoff through the watersheds of the region. Fourth, we explain the water quality importance of open space and habitat buffers in community planning. Fifth, we highlight the importance of understanding the connection between the land use planning associated with growth and the related watershed realities and dynamics.

The memorandum concludes with recommended policy themes to help align growth with adequate water supply and improved water quality. As the work of the Growth Visioning Sub-committee continues and as specific growth scenarios become clearer, staff will build upon the first steps provided in this memorandum and move forward with a more focused vision of water and growth.

## WATER SUPPLY

*New Legislation:*

Since 1995, California cities and counties have been encouraged to consider water supply availability in their decision to approve or deny development projects (SB 901). Recent legislation (SB 221 (Kuehl) and SB 610 (Costa)), however, now mandates local governments to explicitly demonstrate adequate water supply before they can approve large projects. SB 221 requires developers to obtain written verification from the city or county that adequate water supply exists for a potential development, and requires the local decision-making body to make findings that reliable water supply will be available to meet the "reasonable needs" of the project. Thus, SB 221 prohibits approval of projects that lack sufficient documentation of adequate water supply. SB 610 also requires public water suppliers to assess whether total water supplies will meet the projected water demand of the proposed project (if the project is larger than 500 units) and requires that this assessment be included within the project's CEQA document. Thus, SB 221 (Kuehl) and SB 610 (Costa) expand the requirements of SB 901 and require written verification of water availability for new development.

The new legal framework created by SB 221 and SB 610 focuses on water and growth, and, thus, will likely give a more prominent role to growth strategies in the future planning process of cities, counties, and regional water districts in California. Local officials will need to be more involved in long-ranged planning processes and will benefit from being more active participants in the formation of the Water Management Plan used by water providers operating throughout the SCAG region. Cities and counties will also want a clear understanding of water imports, such as the State Water Project and the CalFed and Colorado River 4.4 Plan, and will also need to recognize the important linkages between changing water quality standards and water supply.

*Changing Conditions:*

Providing adequate water resources for Southern California's growing population will be a challenge. The SCAG region is predicted to growth by six million by 2025, yet the quantity of water imported to the region will likely decrease—as water is diverted to competing demands such as population growth outside the region and environmental needs.

The reliability of water imported to California from the Colorado River, for example, has decreased over the years. Southern California now competes with other western states and Indian reservations for water from the Colorado River. Population growth throughout the West and activities in the upper basin headwaters of the Colorado will decrease the reliability of water supply from the Colorado River to California. Environmental needs may further restrict water diversions, since more than 50 federally listed endangered species depend on adequate flows in the Colorado for their survival. The Metropolitan Water District of Southern California, however, is working on storage and other measures to increase the reliability of water supplied by the Colorado River.

The Metropolitan Water District of Southern California is also working to increase the water supply reliability of the State Water Project (SWP). Numerous factors have caused the deterioration of quantity and quality of the SWP supply—including aging infrastructure, sinking Delta levees, and increasing restrictions to help protect the Bay-Delta ecosystem. The Water District predicts that there is only a 15% chance that existing SWP facilities can deliver Metropolitan's full entitlement of 2 million-acre feet any given year. Thus, the Metropolitan Water District is working with the CALFED Bay-Delta Program, a multi-billion dollar project to restore the Bay-Delta's ecosystem and improve the reliability and quality of water export, and Metropolitan is investing in groundwater banking to help ensure adequate water supply during dry years when the Bay-Delta's ecosystems are most vulnerable.

Considering the challenges that face water supplies from the SWP and the Colorado River, extensive regional effort and coordination will be necessary to meet Southern California's future water needs. Thus, it will be necessary to invest in regional water conservation, surplus storage, water recycling, and groundwater recovery measures.

*The Regional Urban Water Management Plan:*

Urban water suppliers serving more than 3000 customers are required to prepare an urban water management plan pursuant to the California Urban Water Management Planning Act (Water Code §10610-10656). Urban water management plans evaluate feasible water efficiency, recycling, and conservation activities, and must be updated and filed with the California Department of Water Resources every five years, with the last plans filed in 2000. The 2005 urban water management plans, therefore, are currently being updated by the dozens of water suppliers in Southern California.

Metropolitan Water District (MWD) is the largest water supplier in Southern California and serves most Southern Californians. Thus, local officials interested in water issues need to understand MWD's 2000 Regional Urban Water Management Plan and localities would benefit from actively participating in the process to update future Urban Water Management plans. The 2000 Plan, for example, includes a comprehensive water resources strategy, labeled *Integrated Resources Planning* (IRP), which is expected to provide the region with reliable and affordable water supply for the next 25 years.

*Methods to Increase Local Water Supplies:*

Since the regional population is growing while the imported water supply is diminishing, the region will need to rely on methods to increase locally available water supply. Potential methods include: 1) water management practices (water conservation), 2) surplus storage (conjunctive use), 3) water recycling, and 4) seawater desalination.

1) Demand management measures (water conservation)

Water conservation is an effective and relatively low-cost method to reduce demand for water. Considering the cost and future uncertainty of importing water to the region, an emphasis on reducing water demand is an essential part of Southern California's water future. Water districts, in coordination with local partners, will benefit from continually supporting water conservation programs, including education, outreach, incentives and, if necessary, mandates to reduce regional water demand. Existing programs, such as ultra-low-flush toilets, low-volume showerheads, and water-smart landscaping, have made significant reductions in water demand in the region. Future support for effective demand management programs will be crucial to accommodate Southern California's growing population.

2) Groundwater and Local Water Supplies

Effective long-term management of groundwater resources is essential. A particularly promising method of groundwater management is conjunctive use. In simple terms, *conjunctive use* is the practice of recharging groundwater basins during wet periods and then using this surplus water during dry periods. This technique has been employed in Southern California since the 1950's, and there are currently numerous conjunctive use program in Southern California and millions of state dollars being invested into future conjunctive use projects. Refer to Metropolitan Water District's Regional Urban Water Management Plan (2000, III-33) for more details on the relationship between groundwater management and augmenting local water supplies.

In addition to maintaining the quantity of groundwater supply, long-term commitment to groundwater quality is also imperative to ensure the long-term supply of reliable water for Southern California. The federal Superfund program is beginning to show progress toward maintaining and increasing groundwater basin production, and future high-quality groundwater is possible if groundwater management receives continued commitment from local partners.

3) Water recycling

Water recycling is the treatment and disinfection of municipal wastewater to provide a water supply suitable for non-potable (non-drinking water) purposes. Potential uses include irrigating landscape, filling lakes, recharging groundwater basins, and providing water for non-potable uses, such as toilets and industrial uses. An initial obstacle to using recycled water for indoor, non-potable, uses is the need for *dual plumbing*, which is a plumbing system that dually supplies recycled and potable water. Other issues that are slowing the use and acceptance of water recycling include cost, water quality, regulations, institutions, and public acceptance. Although the long-term benefits of water recycling projects tend to outweigh the total costs, the initial infrastructure costs are high. Without education and outreach the public may be resistant to recycling wastewater, and, thus, communities may be concerned about investing in a potentially controversial project. Furthermore, strict state regulations about the use of recycled water limit the potential beneficial uses and increase the associated costs. Water suppliers are also often disconnected from wastewater facilities, and, thus, considerable coordination is needed to transfer treated water from the wastewater facility to the potential non-potable uses. Successful water recycling projects will depend on coordination among institutions, regulators, and the public.

4) Seawater desalination

Historically seawater desalination has not been an economically viable alternative in Southern California, but technological advances may make it a cost-effective option in coming decades. Recent seawater desalination projects proposed in Tampa Florida and the island of Trinidad suggest that, under the right conditions, desalination may be an attractive alternative. The Tampa project, for example, is expected to provide water as low as $560/AF (http://www.sdcwa.org/news/plan2000.phtml). Although the Tampa project benefits from unique characteristics such as low-cost energy that would not be available in Southern California, the project suggests that seawater desalination may be feasible elsewhere.

*Potential impacts of growth patterns on water demand:*

This section of the water supply discussion focuses on a preliminary comparison of the expected impact of two different future growth patterns on water demand and supply. This comparison, between a compaction[1] pattern and a dispersion[2] pattern, is intended to serve as an impetus to further consideration of the relationship between types of growth and water supply/demand and water quality.

Compaction vs. Dispersion

A compact growth pattern would be expected to demand substantially less water than a dispersed pattern. The compaction growth pattern illustrated in "Possible Visions: Southern California-2025" assumes infill within the relatively cooler coastal zone with proportionally more multifamily housing than the dispersion pattern. Factors such as climate and proportion of multifamily housing are important factors affecting water demand (SCAG's 1994 Regional Comprehensive Plan and Guide, p. 10-8). The average residential per capita water use for the Coastal Zone is 97 gallons per day, in contrast to the average Desert Zone demand of 162 gallons per day (RCPG, p. 10-8). Thus, the cooler, denser, compaction growth patterns would be expected to have significantly less water demand than the less dense, warmer, inland dispersion pattern.

A compact growth pattern would help maintain the local water supply. On a regional level, a compact growth pattern would result in less impervious surfaces than a disperse pattern. The compact pattern includes more natural areas that would allow surface water to recharge groundwater aquifers. Thus, compact growth would help maintain the local water supply.

For a more comprehensive discussion of the effects of different growth patterns on the environment, refer to "Our Built and Natural Environment: A Technical Review of the Interactions between Land Use, Transportation and Environmental Quality" (EPA 2000 as posted on www.smartgrowth.org/library/built.html).

As information is gathered over the next several months, we will conduct a broad comparison of likely impacts of the various regional growth patterns on future water quality and water supply/demand.

[1] An illustration of the compaction pattern is presented in Map 6 of "Possible Visions: Southern California-2025."

[2] An illustration of the dispersion pattern is presented in Map 5 of "Possible Visions: Southern California-2025."

WATER SUPPLY PRIORITIES FOR GROWTH VISIONING

In general we urge the Growth Visioning Sub-committee to consider the following water supply planning themes:

- Support Demand Management: education, outreach, and incentives for water conservation.
- Increase local water supply: conjunctive use, water recycling, desalination, etc.
- Protect quality of surface water and groundwater for beneficial uses.
- Reduce impervious surfaces to maintain groundwater recharge.
- Reduce sedimentation (from erosion) that diminishes reservoir storage capacity.
- Avoid potentially toxic land uses in aquifer recharge areas.
- Encourage “water smart” development strategies such as compact, mixed-use, infill growth patterns.

## WATER QUALITY

Land use dramatically affects water quality. In natural areas with vegetative cover and little human disturbance most rainfall soaks into the soil (infiltration). In urbanized areas, however, rainfall instead becomes runoff because surface water is unable to soaks into impervious surfaces. Although the transport of runoff through communities and watersheds varies depending on storm conditions, hydrology and actual land uses and practices; in general, water quality diminishes as runoff volumes rise.

*Growth and Land Coverage:*

The nexus between growth and water quality occurs with the land coverage created by new roads, parking lots, buildings and infrastructure. As population and economic growth create more impervious surfaces, many natural water processes are compromised or eliminated.

As stated above, impervious surfaces prevent the water infiltration that recharges groundwater aquifers—important sources of water and water storage. These impervious surfaces include roofs, pavement and other hardscape. Impervious areas include both buildings (such as houses, factories and stores) and transportation-related areas (such as roads, driveways and parking lots). Typically, transportation-related activities take more than half of all impervious areas where residential and commercial land uses occur. This dominance is expected to grow as increases in vehicle ownership and miles traveled develop.

Runoff varies with land use. In vegetated areas runoff is much lower and slower than commercial areas. For example, the runoff volume from a one-acre parking lot is almost 16 times the runoff volume from an undeveloped meadow (2000 EPA). Parkland runoff that may take an hour to reach a storm drain while parking lot runoff may take only minutes. These differences in flow rates have both pollution and flooding consequences.

*Impacts of Runoff:*

The impacts of runoff vary:

1. The combination of frequent and intense storm events and impervious areas brings higher risks of flooding. With higher flow rates this urban runoff will demand higher capacities from the local storm drain system. If these capacities are deficient, flooding with attendant property losses may occur.
2. Runoff that is directed to storm drains has minimal chance for infiltration into groundwater aquifers, limiting local water supplies and storage potentials.
3. High flow rates of runoff increase erosion, as well as the risks of sediments moving to new locations in the local watershed.
4. As runoff volumes increase the potentials for natural water filtration diminish. These natural processes occur as water is filtered through sediments or soil particles or exposed to microbes.

*Pollution Sources and Land Use:*

Besides the effect on flow, land use directly affects water quality in many other ways. To understand these effects we need to differential between point source pollution and nonpoint source pollution.

Point source pollution refers to contaminants that enter a watershed usually through a pipe. The location of the end of that pipe is documented and the flow out of that pipe is subject to a discharge permit issued by a Regional Water Quality Control Board. Examples of point source pollution are discharges from sewage treatment plants (the wastewater is treated but under the terms of its permit this water still has permissible levels of pollutants in the discharge) and industrial facilities. Because point sources are much easier to regulate than nonpoint sources they were the initial focus of the 1972 Clean Water Act. Regulation of point sources since then has dramatically improved the water quality of many rivers and streams throughout the country.

Unlike point source pollution, nonpoint source pollution, also known as "polluted runoff," has a defused identity. Nonpoint pollution comes from everywhere in a community and is significantly influenced by land uses. A driveway or the road in front of a home may be sources of pollution if spilled oil, leaves, pet waste or other contaminants leave the site and runoff into a storm drain. Nonpoint source pollution is now the major water quality problem in the U.S.

Common nonpoint source pollutants in urban areas are sediment, pathogens, nutrients, oxygen-demanding substances, heavy metals, and oil and other petroleum products:

1. Sediment is a frequent pollutant associated with development activities. It affects aquatic life, shortens reservoir life, and complicates water treatment. Its sources are agricultural land erosion, construction sites, washoff from streets and other impervious areas, and streambank erosion.
2. Pathogens include E. coli (a bacteria used to indicate the presence of fecal waste) and other viruses, bacteria, and protozoa. The source of most pathogens is fecal material from any warm-blooded animal. In rural or agricultural areas, sources include wildlife, livestock manure, and malfunctioning septic systems. In urban areas the major sources are pet wastes, wildlife that may be present in high numbers (such as birds), septic systems in unsewered areas, and sewage treatment plant discharges (which are considered a point source).
3. Nutrients of concern are primarily nitrogen and phosphorus. High concentrations of nitrate in drinking water are toxic to infants and may be harmful to pregnant women. Phosphorus leads to overproduction of algae that clog lakes and reservoirs. Sources of nutrients in agricultural areas include fertilizer, livestock manure, and septic systems. Sources of nutrients in urban areas are fertilizer used on lawns, gardens, and golf courses; pet waste runoff; and discharge from sewage treatment plants or industry.
4. Pesticides can be a concern in drinking water supplies that use surface water. Sources of pesticides are simpler to identify than sources of pathogens or nutrients. They are limited to pesticide application, either in agricultural or urban areas. Studies show that pesticides like diazinon, an insecticide for lawns and gardens, are found frequently in urban areas.
5. Oxygen-demanding substances consist of organic matter that depletes dissolved oxygen when decomposed by microorganisms. Dissolved oxygen is critical to maintaining water quality and aquatic life. Urban runoff with high concentrations of decaying organic matter (such as leaves, grass clippings, and other organic debris) can severely depress dissolved oxygen levels after storm events, impairing the water quality on which plants and fish depend.
6. Metals include lead, copper, cadmium, zinc, mercury, and chromium. They can accumulate in fish tissues and affect sensitive animal and plant species. Sources of metals are automobiles (copper is lost from brake pads, for example), industrial activities, illicit sewage connections, and atmospheric deposition (for example, mercury that is released into the air from combustion and then falls to earth in rainfall at another location).
7. Oil and other petroleum products degrade the appearance of water surfaces, impair fish habitats, and may be toxic to sensitive species. Sources are oil leaks; auto emissions coming off parking lots, roads, and driveway; and improper disposal of waste oil. Concentrations of petroleum-based hydrocarbons are often high enough to kill aquatic organisms.

*Imperviousness and Water Quality:*

Buildings, roads, sidewalks, and other impervious surfaces define the urban/suburban landscape. Impervious surfaces alter the natural hydrology and prevent the infiltration of water into the ground. Impervious surfaces change the flow of stormwater over the landscape. In undeveloped areas, vegetation holds down soil, slows the flow of stormwater over land, and filters out some pollutants, by both the slowing the flow of the water and trapping some pollutants in the root system. In addition, some of the stormwater filters down through the soil, replenishing groundwater sources.

As land is converted to other uses such as commercial developments, many of these natural processes are eliminated as vegetation is cleared and soil paved over. As more impervious surface coverage is added to the landscape, more stormwater flows faster off the land. The greater volume of stormwater increases the possibility of flooding, and the high flow rates of the stormwater does not allow for pollutants to settle out, meaning that more pollution gets concentrated in the stormwater runoff.

Research on urban stream protection finds that stream degradation occurs at relatively low levels of imperviousness of 10% to 20%. Wetlands suffer impairment when impervious surface coverage surpasses 10%. Fish habitat, spawning, and diversity suffers when imperviousness is greater than 10% to 12%. Wetland plants and amphibian populations diminish when impervious surfaces are higher than 10%. The higher the percent impervious surface coverage becomes, the greater the degradation in stream water quality tends to be. Based on this research, streams can be considered stressed in watersheds where the impervious coverage exceeds 10% to 15%.

The link between impervious surfaces and degraded water quality argues for careful comparisons between dispersed and compact development strategies. On a regional or watershed level, greater overall water quality protection is achieved through more concentrated or clustered development. A clustered approach will decrease the overall impervious cover, resulting in greater protection for the overall watershed, as a much larger percentage of the watershed will be left in its natural condition, preserving water quality. In addition, such centralized development can be directed away from sensitive areas such as stream banks to minimize the negative impact on water quality.

## WATER QUALITY PRIORITIES FOR GROWTH VISIONING

*Water Quality Priorities:*

The negative impacts of growth on water quality underscore the need for growth strategies that counteract these impacts. In general we urge the Growth Visioning Sub-committee to consider the following planning themes:

- Minimize impervious areas
- Slow stormwater that comes from the impervious areas
- Reduce pollutant sources on all surfaces.
- Protect critical areas such as buffer areas around streams.
- Plan development on a watershed basis.

## Minimize Impervious Areas

Impervious areas can be reduced by incorporating open spaces into urban areas, reducing road width, planning subdivisions so that driveways are smaller, reducing parking requirements, and using permeable alternatives to pavement such as gravel or porous pavement. These approaches are sometimes called "conservation design." Some of these techniques may require changes in zoning before they can be implemented.

## Slow Stormwater

It is important to eliminate direct connections between impervious areas and local receiving waters. Avoiding these kinds of connections controls the rates of runoff volumes during the critical hours following a storm event. Examples of eliminating direct connections include spreading rooftop runoff over pervious areas and routing road or parking lot runoff to grassy swales rather than to storm drains.

Another slowing device is the use of stormwater basins. Stormwater basins are a response to the increased flow due to impervious areas. These basins hold back the peak stormflow, releasing it at pre-development release rates. A design requirement might specify that peak runoff from a 100-year storm after development must be less than the peak runoff from a 10-year storm before development. The outlet of the basin is usually a pipe sized small enough to allow only the pre-development flow rate. The basin is large enough to hold the flow that arrives from the developed areas, allowing it to discharge at the allowable rate. The release time for stormwater basins is usually 24 hours or less, so stormwater basins do not eliminate base flows in local streams.

Stormwater basins can be either dry (detention ponds) or wet (retention ponds). In some cases constructed wetlands are also used for stormwater management. Dry detention basins are grass or stone-lined depressions that can potentially be used as recreation areas during dry periods, but often they are not designed to be aesthetically pleasing. Although they lower peak flows, they provide minimal water quality treatment. Wet basins are permanent pools of water, designed to store drainage above the normal pool elevation during storm events. These basins also have the benefit of a longer storage time (if the stormwater mixes with the permanent pool), which often results in better water quality treatment. In addition, a certain amount of water can infiltrate between storms and filter out contaminants.

## Reduce Pollution Sources

It is generally less expensive to prevent contaminants from entering stormwater than to treat contaminated water. Many contaminants can be prevented from getting into stormwater through good management practices such as encouraging proper disposal of pet wastes; reducing fertilizer and pesticide use on lawns, gardens, cemeteries, and golf courses; and community hazardous waste and waste oil recycling centers. Regular street and parking lot cleaning can reduce the transport of sediment-bound pollutants. New street sweeping machines pick up much finer materials than older models. Disposal of street sweeping wastes may pose a problem because of possible high levels of lead, copper, zinc and other wastes from automobile traffic, but this clearly shows the importance of removing them before they enter streams.

**Establish Protected Areas**

Look for opportunities to develop stream buffers. Although all land use affects water quality, the riparian areas along the edges of streams and waterways have a particularly important effect. Buffer zones or "green belts" along streams can improve water quality while providing recreational areas for residents. Buffer zones are particularly effective at reducing streambank erosion, filtering out sediment and sediment-bound contaminants, and promoting healthy aquatic life in the stream. They also promote infiltration, and if the primary pathway followed by runoff water is overland (rather than through pipes), they will reduce dissolved contaminants. Stream buffers can be protected by regulations, purchase of the land, or easements to prevent development in important riparian areas. Protecting these areas usually has a disproportionately large effect on water quality and should be a priority in any growth planning.

**Plan Development on a Watershed Basis**

Subdivisions usually require a detailed drainage or water management plan as a part of the entitlement process. In many cases a drainage plan for the site itself is all that is considered, rather than how the development affects the entire watershed. In order to protect streams and watersheds, a broader approach is needed.

A watershed approach would require an analysis of the watershed in which the proposed development is located and how the proposed development fits into the cumulative impacts of all development planned in the watershed. The advantage of planning on a watershed basis is that it may be most beneficial to nearby rivers or streams as a whole if development is concentrated in certain high-density areas, while other areas are left as open space. Another aspect of watershed-based planning is preparing an inventory of important natural resources throughout the watershed, and implementing setback distances from critical resources. Development should be concentrated in areas that are not classified as critical resources.

## SUMMARY OF WATER PRIORITIES FOR GROWTH VISIONING

In Summary, we urge the Growth Visioning Sub-committee to consider the following water supply and water quality planning themes:

- Support Demand Management: education, outreach, and incentives for water conservation
- Increase local water supply: conjunctive use, water recycling, desalination, etc.
- Protect quality of surface water *and* groundwater for beneficial uses
- Reduce impervious surfaces to maintain groundwater recharge
- Reduce sedimentation (from erosion) that diminishes reservoir storage capacity
- Avoid potentially toxic land uses in aquifer recharge areas
- Encourage “water smart” development strategies, such as compact, mixed-use, infill growth patterns.
- Minimize impervious areas to maintain water quality
- Slow stormwater from the impervious areas
- Reduce pollutant sources on all surfaces.
- Protect critical areas such as buffer areas around streams.
- Apply a problem-solving, systems-planning, approach to help solve water challenges.
- Plan development on a watershed basis.